



SEQUENCE LISTING

<110> Smith, Michael D.
Potter, Robert J.
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<120> Thermostable Reverse Transcriptases and Uses Thereof

<130> 0942.5040001/RWE/MTT

<140> US 09/845,157

<141> 2001-05-01

<150> US 60/207,196

<151> 2000-05-26

<160> 8

<170> PatentIn version 3.0

<210> 1

<211> 2151

<212> DNA

<213> Moloney-Murine Leukemia Virus

<220>

<221> CDS

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| | | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Gly | Gly | Ser | His | His | His | His | His | Gly | Met | Ala | Ser | Met | Thr | | | |
| 1 | | | | 5 | | | | 10 | | | | 15 | | | | | |
| ggt | gga | cag | caa | atg | ggt | cg | gat | ctg | tac | gac | gat | gac | gat | aag | cat | 96 | |
| Gly | Gly | Gln | Gln | Met | Gly | Arg | Asp | Leu | Tyr | Asp | Asp | Asp | Asp | Lys | His | | |
| | | | | 20 | | | | 25 | | | | 30 | | | | | |
| atg | acc | cta | aat | ata | gaa | gat | gag | tat | cg | cta | cat | gag | acc | tca | aaa | 144 | |
| Met | Thr | Leu | Asn | Ile | Glu | Asp | Glu | Tyr | Arg | Leu | His | Glu | Thr | Ser | Lys | | |
| | | | | 35 | | | | 40 | | | 45 | | | | | | |
| gag | cca | gat | gtt | tct | cta | ggg | tcc | aca | tgg | ctg | tct | gat | ttt | cct | cag | 192 | |
| Glu | Pro | Asp | Val | Ser | Leu | Gly | Ser | Thr | Trp | Leu | Ser | Asp | Phe | Pro | Gln | | |
| | | | | 50 | | | | 55 | | | 60 | | | | | | |
| gcc | tgg | g | g | gaa | acc | ggg | ggc | atg | gga | ctg | gca | gtt | cgc | caa | gct | cct | 240 |
| Ala | Trp | Ala | Glu | Thr | Gly | Gly | Met | Gly | Leu | Ala | Val | Arg | Gln | Ala | Pro | | |
| | | | | 65 | | | | 70 | | | 75 | | 80 | | | | |
| ctg | atc | ata | ctt | ctg | aaa | gca | acc | tct | acc | ccc | gtg | tcc | ata | aaa | caa | 288 | |
| Leu | Ile | Ile | Leu | Leu | Lys | Ala | Thr | Ser | Thr | Pro | Val | Ser | Ile | Lys | Gln | | |
| | | | | 85 | | | | 90 | | | 95 | | | | | | |
| tac | ccc | atg | tca | caa | gaa | gcc | aga | ctg | ggg | atc | aag | ccc | cac | ata | cag | 336 | |
| Tyr | Pro | Met | Ser | Gln | Glu | Ala | Arg | Leu | Gly | Ile | Lys | Pro | His | Ile | Gln | | |
| | | | | 100 | | | | 105 | | | 110 | | | | | | |
| aga | ctg | ttg | gac | cag | gga | ata | ctg | gta | ccc | tgc | cag | tcc | ccc | tgg | aac | 384 | |
| Arg | Leu | Leu | Asp | Gln | Gly | Ile | Leu | Val | Pro | Cys | Gln | Ser | Pro | Trp | Asn | | |
| | | | | 115 | | | | 120 | | | 125 | | | | | | |
| acg | ccc | ctg | cta | ccc | gtc | aag | aaa | ccc | ggg | act | aat | gat | tac | agg | cct | 432 | |
| Thr | Pro | Leu | Leu | Pro | Val | Lys | Lys | Pro | Gly | Thr | Asn | Asp | Tyr | Arg | Pro | | |
| | | | | 130 | | | | 135 | | | 140 | | | | | | |
| gtc | caa | gat | ctg | aga | gag | gtc | aac | aaa | cgc | gta | gaa | gac | atc | cac | ccc | 480 | |
| Val | Gln | Asp | Leu | Arg | Glu | Val | Asn | Lys | Arg | Val | Glu | Asp | Ile | His | Pro | | |
| | | | | 145 | | | | 150 | | | 155 | | 160 | | | | |
| acc | gta | ccc | aac | ccc | tac | aac | ctc | ttg | agt | ggg | ctc | cca | ccg | tcc | cac | 528 | |
| Thr | Val | Pro | Asn | Pro | Tyr | Asn | Leu | Leu | Ser | Gly | Leu | Pro | Pro | Ser | His | | |
| | | | | 165 | | | | 170 | | | 175 | | | | | | |
| cag | tgg | tac | act | gtt | cta | gac | tta | aaa | gat | gcc | ttt | ttc | tgc | ctg | aga | 576 | |
| Gln | Trp | Tyr | Thr | Val | Leu | Asp | Leu | Lys | Asp | Ala | Phe | Phe | Cys | Leu | Arg | | |
| | | | | 180 | | | | 185 | | | 190 | | | | | | |
| ctc | cac | ccg | acg | tct | cag | cct | ctc | ttc | gcc | ttt | gaa | tgg | aga | gac | cca | 624 | |
| Leu | His | Pro | Thr | Ser | Gln | Pro | Leu | Phe | Ala | Phe | Glu | Trp | Arg | Asp | Pro | | |
| | | | | 195 | | | | 200 | | | 205 | | | | | | |
| gag | atg | gga | atc | tct | ggc | caa | cta | acc | tgg | acc | aga | ctc | cca | cag | gga | 672 | |
| Glu | Met | Gly | Ile | Ser | Gly | Gln | Leu | Thr | Trp | Thr | Arg | Leu | Pro | Gln | Gly | | |
| | | | | 210 | | | | 215 | | | 220 | | | | | | |
| ttc | aaa | aac | agt | ccc | acc | ctg | ttt | gat | gag | gca | ctg | cgc | aga | gac | cta | 720 | |
| Phe | Lys | Asn | Ser | Pro | Thr | Leu | Phe | Asp | Glu | Ala | Leu | Arg | Arg | Asp | Leu | | |

| 225 | 230 | 235 | 240 | |
|---|-----|-----|-----|------|
| gca gac ttc cgg atc cag cac cca gac ttg atc ctg cta cag tac gta | | | | 768 |
| Ala Asp Phe Arg Ile Gln His Pro Asp Leu Ile Leu Leu Gln Tyr Val | | | | |
| 245 | 250 | 255 | | |
| gat gac tta ctg ctg gcc gcc act tct gag ctc gac tgc caa caa ggt | | | | 816 |
| Asp Asp Leu Leu Leu Ala Ala Thr Ser Glu Leu Asp Cys Gln Gln Gly | | | | |
| 260 | 265 | 270 | | |
| act cgg gcc ctg tta caa acc cta gga gac ctc ggg tat cgg gcc tcg | | | | 864 |
| Thr Arg Ala Leu Leu Gln Thr Leu Gly Asp Leu Gly Tyr Arg Ala Ser | | | | |
| 275 | 280 | 285 | | |
| gcc aag aaa gcc caa att tgc cag aaa cag gtc aag tat ctg ggg tat | | | | 912 |
| Ala Lys Lys Ala Gln Ile Cys Gln Lys Gln Val Lys Tyr Leu Gly Tyr | | | | |
| 290 | 295 | 300 | | |
| ctt cta aaa gag ggt cag aga tgg ctg act gag gcc aga aaa gag act | | | | 960 |
| Leu Leu Lys Glu Gly Gln Arg Trp Leu Thr Glu Ala Arg Lys Glu Thr | | | | |
| 305 | 310 | 315 | 320 | |
| gtg atg ggg cag cct act ccg aag acc ccg cgg caa cta agg gag ttc | | | | 1008 |
| Val Met Gly Gln Pro Thr Pro Lys Thr Pro Arg Gln Leu Arg Glu Phe | | | | |
| 325 | 330 | 335 | | |
| cta ggg acg gca ggc ttc tgt cgc ctc tgg atc cct ggg ttt gca gaa | | | | 1056 |
| Leu Gly Thr Ala Gly Phe Cys Arg Leu Trp Ile Pro Gly Phe Ala Glu | | | | |
| 340 | 345 | 350 | | |
| atg gca gcc ccc ttg tac cct ctc acc aaa acg ggg act ctg ttt aat | | | | 1104 |
| Met Ala Ala Pro Leu Tyr Pro Leu Thr Lys Thr Gly Thr Leu Phe Asn | | | | |
| 355 | 360 | 365 | | |
| tgg ggc cca gac caa caa aag gcc tat caa gaa atc aag caa gct ctt | | | | 1152 |
| Trp Gly Pro Asp Gln Gln Lys Ala Tyr Gln Glu Ile Lys Gln Ala Leu | | | | |
| 370 | 375 | 380 | | |
| cta act gcc cca gcc ctg ggg ttg cca gat ttg act aag ccc ttt gaa | | | | 1200 |
| Leu Thr Ala Pro Ala Leu Gly Leu Pro Asp Leu Thr Lys Pro Phe Glu | | | | |
| 385 | 390 | 395 | 400 | |
| ctc ttt gtc gac gag aag cag ggc tac gcc aaa ggt gtc cta acg caa | | | | 1248 |
| Leu Phe Val Asp Glu Lys Gln Gly Tyr Ala Lys Gly Val Leu Thr Gln | | | | |
| 405 | 410 | 415 | | |
| aaa ctg gga cct tgg cgt cgg ccg gtg gcc tac ctg tcc aaa aag cta | | | | 1296 |
| Lys Leu Gly Pro Trp Arg Arg Pro Val Ala Tyr Leu Ser Lys Lys Leu | | | | |
| 420 | 425 | 430 | | |
| gac cca gta gca gct ggg tgg ccc cct tgc cta cgg atg gta gca gcc | | | | 1344 |
| Asp Pro Val Ala Ala Gly Trp Pro Pro Cys Leu Arg Met Val Ala Ala | | | | |
| 435 | 440 | 445 | | |
| att gcc gta ctg aca aag gat gca ggc aag cta acc atg gga cag cca | | | | 1392 |
| Ile Ala Val Leu Thr Lys Asp Ala Gly Lys Leu Thr Met Gly Gln Pro | | | | |
| 450 | 455 | 460 | | |

| | |
|---|------|
| cta gtc att ctg gcc ccc cat gca gta gag gca cta gtc aaa caa ccc Leu Val Ile Leu Ala Pro His Ala Val Glu Ala Leu Val Lys Gln Pro 465 470 475 480 | 1440 |
| ccc gat cga tgg ctt tcc aac gcc cg ^g atg act cac tat cag gcc ttg Pro Asp Arg Trp Leu Ser Asn Ala Arg Met Thr His Tyr Gln Ala Leu 485 490 495 | 1488 |
| ctt ttg gac acg gac cg ^g gtc cag ttc gga cc ^g gtg gta gcc ctg aac Leu Leu Asp Thr Asp Arg Val Gln Phe Gly Pro Val Val Ala Leu Asn 500 505 510 | 1536 |
| ccg gct aca ctg ctc cca ctg cct gag gaa ggg ctg cag cac aac tgc Pro Ala Thr Leu Leu Pro Leu Pro Glu Glu Gly Leu Gln His Asn Cys 515 520 525 | 1584 |
| ctt gat atc ctg gcc gaa gcc cac gga acc cga ccc gac cta acg gac Leu Asp Ile Leu Ala Glu Ala His Gly Thr Arg Pro Asp Leu Thr Asp 530 535 540 | 1632 |
| cag ccg ctc cca gac gcc gac cac acc tgg tac acg ggt gga tcc agt Gln Pro Leu Pro Asp Ala Asp His Thr Trp Tyr Thr Gly Gly Ser Ser 545 550 555 560 | 1680 |
| ctc ttg caa gag gga cag cgt aag gcg gga gct gcg gtg acc acc gag Leu Leu Gln Glu Gly Gln Arg Lys Ala Gly Ala Ala Val Thr Thr Glu 565 570 575 | 1728 |
| acc gag gta atc tgg gct aaa gcc ctg cca gcc ggg aca tcc gct cag Thr Glu Val Ile Trp Ala Lys Ala Leu Pro Ala Gly Thr Ser Ala Gln 580 585 590 | 1776 |
| cg ^g gct cag ctg ata gca ctc acc cag gcc cta agg atg gca gaa ggt Arg Ala Gln Leu Ile Ala Leu Thr Gln Ala Leu Arg Met Ala Glu Gly 595 600 605 | 1824 |
| aag aag cta aat gtt tat acg aat tcc cgt tat gct ttt gct act gcc Lys Lys Leu Asn Val Tyr Thr Asn Ser Arg Tyr Ala Phe Ala Thr Ala 610 615 620 | 1872 |
| cat atc cat gga gaa ata tac aga agg cgt ggg ttg ctc aca tca gaa His Ile His Gly Glu Ile Tyr Arg Arg Gly Leu Leu Thr Ser Glu 625 630 635 640 | 1920 |
| ggc aaa gag atc aaa aat aag gac gag ata ttg gcc cta cta aaa gcc Gly Lys Glu Ile Lys Asn Lys Asp Glu Ile Leu Ala Leu Leu Lys Ala 645 650 655 | 1968 |
| ctc ttt ctg ccc aaa aga ctt agc ata atc cat tgt cca gga cat caa Leu Phe Leu Pro Lys Arg Leu Ser Ile Ile His Cys Pro Gly His Gln 660 665 670 | 2016 |
| aag gga cac agc gcc gag gct aga ggc aac cg ^g atg gct gac caa gc ^g Lys Gly His Ser Ala Glu Ala Arg Gly Asn Arg Met Ala Asp Gln Ala 675 680 685 | 2064 |

gcc cga aag gca gcc atc aca gag aat cca gac acc tct acc ctc ctc 2112
Ala Arg Lys Ala Ala Ile Thr Glu Asn Pro Asp Thr Ser Thr Leu Leu
690 695 700

ata gaa aat tca tca ccc aat tcc cgc tta att aat taa 2151
Ile Glu Asn Ser Ser Pro Asn Ser Arg Leu Ile Asn
705 710 715

<210> 2

<211> 716

<212> PRT

<213> Moloney-Murine Leukemia Virus

<400> 2

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Gly Gly Gln Gln Met Gly Arg Asp Leu Tyr Asp Asp Asp Asp Lys His
20 25 30

Met Thr Leu Asn Ile Glu Asp Glu Tyr Arg Leu His Glu Thr Ser Lys
35 40 45

Glu Pro Asp Val Ser Leu Gly Ser Thr Trp Leu Ser Asp Phe Pro Gln
50 55 60

Ala Trp Ala Glu Thr Gly Gly Met Gly Leu Ala Val Arg Gln Ala Pro
65 70 75 80

Leu Ile Ile Leu Leu Lys Ala Thr Ser Thr Pro Val Ser Ile Lys Gln
85 90 95

Tyr Pro Met Ser Gln Glu Ala Arg Leu Gly Ile Lys Pro His Ile Gln
100 105 110

Arg Leu Leu Asp Gln Gly Ile Leu Val Pro Cys Gln Ser Pro Trp Asn
115 120 125

Thr Pro Leu Leu Pro Val Lys Lys Pro Gly Thr Asn Asp Tyr Arg Pro
130 135 140

Val Gln Asp Leu Arg Glu Val Asn Lys Arg Val Glu Asp Ile His Pro

| 145 | 150 | 155 | 160 |
|---|-----|-----|-----|
| Thr Val Pro Asn Pro Tyr Asn Leu Leu Ser Gly Leu Pro Pro Ser His | | | |
| 165 | 170 | 175 | |
| Gln Trp Tyr Thr Val Leu Asp Leu Lys Asp Ala Phe Phe Cys Leu Arg | | | |
| 180 | 185 | 190 | |
| Leu His Pro Thr Ser Gln Pro Leu Phe Ala Phe Glu Trp Arg Asp Pro | | | |
| 195 | 200 | 205 | |
| Glu Met Gly Ile Ser Gly Gln Leu Thr Trp Thr Arg Leu Pro Gln Gly | | | |
| 210 | 215 | 220 | |
| Phe Lys Asn Ser Pro Thr Leu Phe Asp Glu Ala Leu Arg Arg Asp Leu | | | |
| 225 | 230 | 235 | 240 |
| Ala Asp Phe Arg Ile Gln His Pro Asp Leu Ile Leu Leu Gln Tyr Val | | | |
| 245 | 250 | 255 | |
| Asp Asp Leu Leu Ala Ala Thr Ser Glu Leu Asp Cys Gln Gln Gly | | | |
| 260 | 265 | 270 | |
| Thr Arg Ala Leu Leu Gln Thr Leu Gly Asp Leu Gly Tyr Arg Ala Ser | | | |
| 275 | 280 | 285 | |
| Ala Lys Lys Ala Gln Ile Cys Gln Lys Gln Val Lys Tyr Leu Gly Tyr | | | |
| 290 | 295 | 300 | |
| Leu Leu Lys Glu Gly Gln Arg Trp Leu Thr Glu Ala Arg Lys Glu Thr | | | |
| 305 | 310 | 315 | 320 |
| Val Met Gly Gln Pro Thr Pro Lys Thr Pro Arg Gln Leu Arg Glu Phe | | | |
| 325 | 330 | 335 | |
| Leu Gly Thr Ala Gly Phe Cys Arg Leu Trp Ile Pro Gly Phe Ala Glu | | | |
| 340 | 345 | 350 | |
| Met Ala Ala Pro Leu Tyr Pro Leu Thr Lys Thr Gly Thr Leu Phe Asn | | | |
| 355 | 360 | 365 | |
| Trp Gly Pro Asp Gln Gln Lys Ala Tyr Gln Glu Ile Lys Gln Ala Leu | | | |
| 370 | 375 | 380 | |

Leu Thr Ala Pro Ala Leu Gly Leu Pro Asp Leu Thr Lys Pro Phe Glu
385 390 395 400

Leu Phe Val Asp Glu Lys Gln Gly Tyr Ala Lys Gly Val Leu Thr Gln
405 410 415

Lys Leu Gly Pro Trp Arg Arg Pro Val Ala Tyr Leu Ser Lys Lys Leu
420 425 430

Asp Pro Val Ala Ala Gly Trp Pro Pro Cys Leu Arg Met Val Ala Ala
435 440 445

Ile Ala Val Leu Thr Lys Asp Ala Gly Lys Leu Thr Met Gly Gln Pro
450 455 460

Leu Val Ile Leu Ala Pro His Ala Val Glu Ala Leu Val Lys Gln Pro
465 470 475 480

Pro Asp Arg Trp Leu Ser Asn Ala Arg Met Thr His Tyr Gln Ala Leu
485 490 495

Leu Leu Asp Thr Asp Arg Val Gln Phe Gly Pro Val Val Ala Leu Asn
500 505 510

Pro Ala Thr Leu Leu Pro Leu Pro Glu Glu Gly Leu Gln His Asn Cys
515 520 525

Leu Asp Ile Leu Ala Glu Ala His Gly Thr Arg Pro Asp Leu Thr Asp
530 535 540

Gln Pro Leu Pro Asp Ala Asp His Thr Trp Tyr Thr Gly Gly Ser Ser
545 550 555 560

Leu Leu Gln Glu Gly Gln Arg Lys Ala Gly Ala Ala Val Thr Thr Glu
565 570 575

Thr Glu Val Ile Trp Ala Lys Ala Leu Pro Ala Gly Thr Ser Ala Gln
580 585 590

Arg Ala Gln Leu Ile Ala Leu Thr Gln Ala Leu Arg Met Ala Glu Gly
595 600 605

Lys Lys Leu Asn Val Tyr Thr Asn Ser Arg Tyr Ala Phe Ala Thr Ala
610 615 620

His Ile His Gly Glu Ile Tyr Arg Arg Arg Gly Leu Leu Thr Ser Glu
625 630 635 640

Gly Lys Glu Ile Lys Asn Lys Asp Glu Ile Leu Ala Leu Leu Lys Ala
645 650 655

Leu Phe Leu Pro Lys Arg Leu Ser Ile Ile His Cys Pro Gly His Gln
660 665 670

Lys Gly His Ser Ala Glu Ala Arg Gly Asn Arg Met Ala Asp Gln Ala
675 680 685

Ala Arg Lys Ala Ala Ile Thr Glu Asn Pro Asp Thr Ser Thr Leu Leu
690 695 700

Ile Glu Asn Ser Ser Pro Asn Ser Arg Leu Ile Asn
705 710 715

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<213> Artificial

<220>

<223> Oligonucleotide template

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47

<210> 4

<211> 18

<212> DNA

<213> Artificial

<220>

<223> Oligonucleotide primer

<400> 4
cttccattca cacactgc 18

<210> 5

<211> 21

<212> DNA

<213> Artificial

<220>

<223> Oligonucleotide primer

<400> 5
gaagatcgca ctccagccag c 21

<210> 6

<211> 298

<212> DNA

<213> Escherichia coli

<400> 6
agcgcaacgc aattaatgtg agttagctca ctcattaggc accccaggct ttacacttta 60
tgcttccggc tcgtatgttg tgtggaattt tgagcggata acaatttcac acaggaaaca 120
gctatgacca tgattacgcc aagcttgcatt gcctgcaggc cgactctaga ggatccccgg 180
gtaccgagct cgaatttcaact ggccgtcggt ttacaacgtc gtgactggga aaaccctggc 240
gttacccaaac ttaatcgccct tgcagcacat ccccctttcg ccagctggcg taatagcg 298

<210> 7

<211> 1575

<212> DNA

<213> Moloney-Murine Leukemia Virus

<220>

<221> CDS

<222> (1) . . (1575)

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1 5 10 15

gag cca gat gtt tct cta ggg tcc aca tgg ctg tct gat ttt cct cag 96
Glu Pro Asp Val Ser Leu Gly Ser Thr Trp Leu Ser Asp Phe Pro Gln
20 25 30

gcc tgg gcg gaa acc ggg ggc atg gga ctg gca gtt cgc caa gct cct 144
Ala Trp Ala Glu Thr Gly Gly Met Gly Leu Ala Val Arg Gln Ala Pro
35 40 45

ctg atc ata cct ctg aaa gca acc tct acc ccc gtg tcc ata aaa caa 192
Leu Ile Ile Pro Leu Lys Ala Thr Ser Thr Pro Val Ser Ile Lys Gln
50 55 60

tac ccc atg tca caa gaa gcc aga ctg ggg atc aag ccc cac ata cag 240
Tyr Pro Met Ser Gln Glu Ala Arg Leu Gly Ile Lys Pro His Ile Gln
65 70 75 80

aga ctg ttg gac cag gga ata ctg gta ccc tgc cag tcc ccc tgg aac 288
Arg Leu Leu Asp Gln Gly Ile Leu Val Pro Cys Gln Ser Pro Trp Asn
85 90 95

acg ccc ctg cta ccc gtt aag aaa cca ggg act aat gat tat agg cct 336
Thr Pro Leu Leu Pro Val Lys Lys Pro Gly Thr Asn Asp Tyr Arg Pro
100 105 110

gtc cag gat ctg aga gaa gtc aac aag cgg gtg gaa gac atc cac ccc 384
Val Gln Asp Leu Arg Glu Val Asn Lys Arg Val Glu Asp Ile His Pro
115 120 125

acc gtg ccc aac cct tac aac ctc ttg agc ggg ctc aag cgg gtg gaa 432
Thr Val Pro Asn Pro Tyr Asn Leu Leu Ser Gly Leu Lys Arg Val Glu
130 135 140

gac atc cac ccc acc gtg ccc aac cct tac aac ctc ttg agc ggg ctc 480
Asp Ile His Pro Thr Val Pro Asn Pro Tyr Asn Leu Leu Ser Gly Leu
145 150 155 160

cca ccg tcc cac cag tgg tac act gtg ctt gat tta aag gat gcc ttt 528
Pro Pro Ser His Gln Trp Tyr Thr Val Leu Asp Leu Lys Asp Ala Phe
165 170 175

ttc tgc ctg aga ctc cac ccc acc agt cag cct ctc ttc gcc ttt gag 576
Phe Cys Leu Arg Leu His Pro Thr Ser Gln Pro Leu Phe Ala Phe Glu
180 185 190

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| tgg | aga | gat | cca | gag | atg | gga | atc | tca | gga | caa | ttg | acc | tgg | acc | aga | 624 |
| Trp | Arg | Asp | Pro | Glu | Met | Gly | Ile | Ser | Gly | Gln | Leu | Thr | Trp | Thr | Arg | |
| 195 | | | | | | | 200 | | | | | 205 | | | | |
| ctc | cca | cag | ggt | ttc | aaa | aac | agt | ccc | acc | ctg | ttt | gat | gag | gca | ctg | 672 |
| Leu | Pro | Gln | Gly | Phe | Lys | Asn | Ser | Pro | Thr | Leu | Phe | Asp | Glu | Ala | Leu | |
| 210 | | | | | | 215 | | | | 220 | | | | | | |
| cac | aga | gac | cta | gca | gac | ttc | cgg | atc | cag | cac | cca | gac | ttg | atc | ctg | 720 |
| His | Arg | Asp | Leu | Ala | Asp | Phe | Arg | Ile | Gln | His | Pro | Asp | Leu | Ile | Leu | |
| 225 | | | | | | 230 | | | 235 | | | 240 | | | | |
| cta | cag | tac | gtg | gat | gac | tta | ctg | ctg | gcc | gcc | act | tct | gag | cta | gac | 768 |
| Leu | Gln | Tyr | Val | Asp | Asp | Leu | Leu | Ala | Ala | Thr | Ser | Glu | Leu | Asp | | |
| | | | | | | 245 | | | 250 | | | 255 | | | | |
| tgc | caa | caa | ggt | act | cgg | gcc | ctg | tta | caa | acc | cta | ggg | aac | ctc | ggg | 816 |
| Cys | Gln | Gln | Gly | Thr | Arg | Ala | Leu | Leu | Gln | Thr | Leu | Gly | Asn | Leu | Gly | |
| 260 | | | | | | 265 | | | | 270 | | | | | | |
| tat | cgg | gcc | tcg | gcc | aag | aaa | gcc | caa | att | tgc | cag | aaa | cag | gtc | aag | 864 |
| Tyr | Arg | Ala | Ser | Ala | Lys | Lys | Ala | Gln | Ile | Cys | Gln | Lys | Gln | Val | Lys | |
| 275 | | | | | | 280 | | | | 285 | | | | | | |
| tat | ctg | ggg | tat | ctt | cta | aaa | gag | ggt | cag | aga | ttg | ctg | act | gag | gcc | 912 |
| Tyr | Leu | Gly | Tyr | Leu | Leu | Lys | Glu | Gly | Gln | Arg | Trp | Leu | Thr | Glu | Ala | |
| 290 | | | | | | 295 | | | | 300 | | | | | | |
| aga | aaa | gag | act | gtg | atg | ggg | cag | cct | act | ccg | aag | acc | cct | cga | caa | 960 |
| Arg | Lys | Glu | Thr | Val | Met | Gly | Gln | Pro | Thr | Pro | Lys | Thr | Pro | Arg | Gln | |
| 305 | | | | | | 310 | | | 315 | | | 320 | | | | |
| cta | agg | gag | ttc | cta | ggg | acg | gca | ggc | ttc | tgt | cgc | ctc | tgg | atc | cct | 1008 |
| Leu | Arg | Glu | Phe | Leu | Gly | Thr | Ala | Gly | Phe | Cys | Arg | Leu | Trp | Ile | Pro | |
| | | | | | | 325 | | | 330 | | | 335 | | | | |
| ggg | ttt | gca | gaa | atg | gca | gcc | ccc | ttg | tac | cct | ctc | acc | aaa | acg | ggg | 1056 |
| Gly | Phe | Ala | Glu | Met | Ala | Ala | Pro | Leu | Tyr | Pro | Leu | Thr | Lys | Thr | Gly | |
| 340 | | | | | | 345 | | | | 350 | | | | | | |
| act | ctg | ttt | aat | tgg | ggc | cca | gac | caa | caa | aag | gcc | tat | caa | gaa | atc | 1104 |
| Thr | Leu | Phe | Asn | Trp | Gly | Pro | Asp | Gln | Gln | Lys | Ala | Tyr | Gln | Glu | Ile | |
| 355 | | | | | | 360 | | | | 365 | | | | | | |
| aag | caa | gct | ctt | cta | act | gcc | cca | gcc | ctg | ggg | ttg | cca | gat | ttg | act | 1152 |
| Lys | Gln | Ala | Leu | Leu | Thr | Ala | Pro | Ala | Leu | Gly | Leu | Pro | Asp | Leu | Thr | |
| 370 | | | | | | 375 | | | | 380 | | | | | | |
| aag | ccc | ttt | gaa | ctc | ttt | gtc | gac | gag | aag | cag | ggc | tac | gcc | aaa | ggt | 1200 |
| Lys | Pro | Phe | Glu | Leu | Phe | Val | Asp | Glu | Lys | Gln | Gly | Tyr | Ala | Lys | Gly | |
| 385 | | | | | | 390 | | | | 395 | | | 400 | | | |
| gtc | cta | acg | caa | aaa | ctg | gga | cct | tgg | cgt | cg | ccg | gtg | gcc | tac | ctg | 1248 |
| Val | Leu | Thr | Gln | Lys | Leu | Gly | Pro | Trp | Arg | Arg | Pro | Val | Ala | Tyr | Leu | |
| | | | | | | 405 | | | 410 | | | 415 | | | | |
| tcc | aaa | aag | cta | gac | cca | gta | gca | gct | ggg | tgg | ccc | cct | tgc | cta | cg | 1296 |

| | | | | | | | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Ser | Lys | Lys | Leu | Asp | Pro | Val | Ala | Ala | Gly | Trp | Pro | Pro | Cys | Leu | Arg | |
| 420 | | | | | | | 425 | | | | | | | 430 | | |
| atg | gta | gca | gcc | att | gcc | gta | ctg | aca | aag | gat | gca | ggc | aag | cta | acc | 1344 |
| Met | Val | Ala | Ala | Ile | Ala | Val | Leu | Thr | Lys | Asp | Ala | Gly | Lys | Leu | Thr | |
| 435 | | | | | | | 440 | | | | | | 445 | | | |
| atg | gga | cag | cca | cta | gtc | att | ctg | gcc | ccc | cat | gca | gta | gag | gca | cta | 1392 |
| Met | Gly | Gln | Pro | Leu | Val | Ile | Leu | Ala | Pro | His | Ala | Val | Glu | Ala | Leu | |
| 450 | | | | | | | 455 | | | | | 460 | | | | |
| gtc | aaa | caa | ccc | ccc | gac | cgc | tgg | ctt | tcc | aac | gcc | cg | atg | act | cac | 1440 |
| Val | Lys | Gln | Pro | Pro | Asp | Arg | Trp | Leu | Ser | Asn | Ala | Arg | Met | Thr | His | |
| 465 | | | | | | | 470 | | | | | 475 | | | 480 | |
| tat | cag | gcc | ttg | ctt | ttg | gac | acg | gac | cg | gtc | cag | ttc | gga | ccg | gtg | 1488 |
| Tyr | Gln | Ala | Leu | Leu | Leu | Asp | Thr | Asp | Arg | Val | Gln | Phe | Gly | Pro | Val | |
| 485 | | | | | | | 490 | | | | | 495 | | | | |
| gta | gcc | ctg | aac | ccg | gct | acg | ctg | ctc | cca | ctg | cct | gag | gaa | ggg | ctg | 1536 |
| Val | Ala | Leu | Asn | Pro | Ala | Thr | Leu | Leu | Pro | Leu | Pro | Glu | Glu | Gly | Leu | |
| 500 | | | | | | | 505 | | | | | 510 | | | | |
| caa | cac | aac | tgc | ctt | gat | aat | tcc | cgc | tta | att | aat | taa | | | | 1575 |
| Gln | His | Asn | Cys | Leu | Asp | Asn | Ser | Arg | Leu | Ile | Asn | | | | | |
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| <210> 8 | | | | | | | | | | | | | | | | |
| <211> 524 | | | | | | | | | | | | | | | | |
| <212> PRT | | | | | | | | | | | | | | | | |
| <213> Moloney-Murine Leukemia Virus | | | | | | | | | | | | | | | | |
| <400> 8 | | | | | | | | | | | | | | | | |
| Met Thr Leu Asn Ile Glu Asp Glu His Arg Leu His Glu Thr Ser Lys | | | | | | | | | | | | | | | | |
| 1 | | | | 5 | | | | 10 | | | | | 15 | | | |
| Glu Pro Asp Val Ser Leu Gly Ser Thr Trp Leu Ser Asp Phe Pro Gln | | | | | | | | | | | | | | | | |
| | | | | | | | 20 | | | | | 25 | | | 30 | |
| Ala Trp Ala Glu Thr Gly Gly Met Gly Leu Ala Val Arg Gln Ala Pro | | | | | | | | | | | | | | | | |
| | | | | | | | 35 | | | | | 40 | | | 45 | |
| Leu Ile Ile Pro Leu Lys Ala Thr Ser Thr Pro Val Ser Ile Lys Gln | | | | | | | | | | | | | | | | |
| | | | | | | | 50 | | | | | 55 | | | 60 | |
| Tyr Pro Met Ser Gln Glu Ala Arg Leu Gly Ile Lys Pro His Ile Gln | | | | | | | | | | | | | | | | |

| 65 | 70 | 75 | 80 | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Arg | Leu | Leu | Asp | Gln | Gly | Ile | Leu | Val | Pro | Cys | Gln | Ser | Pro | Trp | Asn |
| | | | | 85 | | | | | | 90 | | | | | 95 |
| Thr | Pro | Leu | Leu | Pro | Val | Lys | Lys | Pro | Gly | Thr | Asn | Asp | Tyr | Arg | Pro |
| | | | | 100 | | | | 105 | | | | | 110 | | |
| Val | Gln | Asp | Leu | Arg | Glu | Val | Asn | Lys | Arg | Val | Glu | Asp | Ile | His | Pro |
| | | | | 115 | | | 120 | | | | | | 125 | | |
| Thr | Val | Pro | Asn | Pro | Tyr | Asn | Leu | Leu | Ser | Gly | Leu | Lys | Arg | Val | Glu |
| | | | | 130 | | | 135 | | | | 140 | | | | |
| Asp | Ile | His | Pro | Thr | Val | Pro | Asn | Pro | Tyr | Asn | Leu | Leu | Ser | Gly | Leu |
| | | | | 145 | | | 150 | | | 155 | | | 160 | | |
| Pro | Pro | Ser | His | Gln | Trp | Tyr | Thr | Val | Leu | Asp | Leu | Lys | Asp | Ala | Phe |
| | | | | 165 | | | | 170 | | | | | 175 | | |
| Phe | Cys | Leu | Arg | Leu | His | Pro | Thr | Ser | Gln | Pro | Leu | Phe | Ala | Phe | Glu |
| | | | | 180 | | | | 185 | | | | 190 | | | |
| Trp | Arg | Asp | Pro | Glu | Met | Gly | Ile | Ser | Gly | Gln | Leu | Thr | Trp | Thr | Arg |
| | | | | 195 | | | 200 | | | | 205 | | | | |
| Leu | Pro | Gln | Gly | Phe | Lys | Asn | Ser | Pro | Thr | Leu | Phe | Asp | Glu | Ala | Leu |
| | | | | 210 | | | 215 | | | 220 | | | | | |
| His | Arg | Asp | Leu | Ala | Asp | Phe | Arg | Ile | Gln | His | Pro | Asp | Leu | Ile | Leu |
| | | | | 225 | | | 230 | | | 235 | | | 240 | | |
| Leu | Gln | Tyr | Val | Asp | Asp | Leu | Leu | Leu | Ala | Ala | Thr | Ser | Glu | Leu | Asp |
| | | | | 245 | | | | 250 | | | | 255 | | | |
| Cys | Gln | Gln | Gly | Thr | Arg | Ala | Leu | Leu | Gln | Thr | Leu | Gly | Asn | Leu | Gly |
| | | | | 260 | | | | 265 | | | 270 | | | | |
| Tyr | Arg | Ala | Ser | Ala | Lys | Lys | Ala | Gln | Ile | Cys | Gln | Lys | Gln | Val | Lys |
| | | | | 275 | | | 280 | | | | 285 | | | | |
| Tyr | Leu | Gly | Tyr | Leu | Leu | Lys | Glu | Gly | Gln | Arg | Trp | Leu | Thr | Glu | Ala |
| | | | | 290 | | | 295 | | | | 300 | | | | |

Arg Lys Glu Thr Val Met Gly Gln Pro Thr Pro Lys Thr Pro Arg Gln
305 310 315 320

Leu Arg Glu Phe Leu Gly Thr Ala Gly Phe Cys Arg Leu Trp Ile Pro
325 330 335

Gly Phe Ala Glu Met Ala Ala Pro Leu Tyr Pro Leu Thr Lys Thr Gly
340 345 350

Thr Leu Phe Asn Trp Gly Pro Asp Gln Gln Lys Ala Tyr Gln Glu Ile
355 360 365

Lys Gln Ala Leu Leu Thr Ala Pro Ala Leu Gly Leu Pro Asp Leu Thr
370 375 380

Lys Pro Phe Glu Leu Phe Val Asp Glu Lys Gln Gly Tyr Ala Lys Gly
385 390 395 400

Val Leu Thr Gln Lys Leu Gly Pro Trp Arg Arg Pro Val Ala Tyr Leu
405 410 415

Ser Lys Lys Leu Asp Pro Val Ala Ala Gly Trp Pro Pro Cys Leu Arg
420 425 430

Met Val Ala Ala Ile Ala Val Leu Thr Lys Asp Ala Gly Lys Leu Thr
435 440 445

Met Gly Gln Pro Leu Val Ile Leu Ala Pro His Ala Val Glu Ala Leu
450 455 460

Val Lys Gln Pro Pro Asp Arg Trp Leu Ser Asn Ala Arg Met Thr His
465 470 475 480

Tyr Gln Ala Leu Leu Asp Thr Asp Arg Val Gln Phe Gly Pro Val
485 490 495

Val Ala Leu Asn Pro Ala Thr Leu Leu Pro Leu Pro Glu Glu Gly Leu
500 505 510

Gln His Asn Cys Leu Asp Asn Ser Arg Leu Ile Asn
515 520



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Michael D. SMITH *et al.*

Appl. No.: 09/845,157

Filed: May 1, 2001

For: **Thermostable Reverse Transcriptases
and Uses Thereof**

Confirmation No.: 2674

Art Unit: 1637

Examiner: Fredman, Jeffrey N.

Atty. Docket: 0942.5040001/RWE/HCC

**Amendment and Submission of Substitute Sequence Listing
Under 37 C.F.R. § 1.825(a)**

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

In compliance with 37 C.F.R. § 1.825(a), Applicants submit substitute sheets to amend the paper copy of the Sequence Listing.

In the Specification:

Please cancel the existing Sequence Listing for the above-identified application, replace it with the substitute Sequence Listing appended hereto, and insert the same at the end of the application.

Remarks

The changes made in the sequence listing do not include new matter. Support for these amendments can be found in the specification as originally filed on page 34, paragraph 0092, wherein U.S. Patent No. 5,668,005 is incorporated by reference. The specification has been amended to direct the entry of this corrected Sequence Listing at the end of the above identified application.

In accordance with 37 C.F.R. § 1.825(a), this submission contains no new matter.

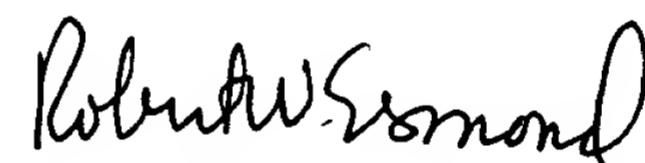
In accordance with 37 C.F.R. § 1.825(b), the paper copy of the Sequence Listing and the computer readable copy of the Sequence Listing submitted herewith are the same.

Summary

It is respectfully believed this application is now in condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.



Robert W. Esmond
Attorney for Applicants
Registration No. 32,893

Date: October 12, 2004

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